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# memorandum

date November 24, 2015

to Kurt Nelson, Tulalip Tribes

from Steve Winter and Ryan Bartelheimer, PE; reviewed by Bob Battalio, PE

subject Qwuloolt Estuary Restoration Site As-Constructed Analysis Update

This memorandum supplements our previous memorandum, submitted July 8, 2015, which together document our observations of the final state of the internal portions of the Qwuloolt Estuary Restoration Site prior to the levee breach. The previous memo is provided as Attachment 1. Attachment 1 from that memo consisted of marked up drawings reflecting as-built conditions at that time, which has been omitted in the attachment to this memo since additional construction has occurred since then. This memo includes observations of the recent construction that has been implemented since the previous memo was completed. Only those observations not previously documented are included here.

The internal portion of the site has been prepared for restoration in a number of phases from 2007 to the present. ESA has provided construction design details for specific features, including tidal channels, ditches to fill, and wave attenuation berms. The primary construction set referenced here is the August 2012 construction set which was largely implemented in 2012, 2013, and 2014.

Please note that this memo focuses only on the habitat features within the restoration site, as you requested. The project elements that we do not address in this memo are related to infrastructure such as stormwater, sewer, trails, and levees.

## Data

For this analysis, we supplemented the data used in our previous memorandum with field observations from site visits in July, August, and September and a final topographic survey of berm elevations provided by Downing Surveyors.

## Observations

Our review of the site indicates that many of the features included in the restoration design are in place and consistent with the design intent. Our observations of the features that were built are shown in Figure 1. There are, however, a number of elements that have not been constructed or have been constructed in ways that deviate from our design due to project budget constraints. The construction drawings were marked up to show which features were constructed and which were not constructed or were constructed differently from the design. These marked up drawings are included as Attachment 2 to this memorandum.

### ***Drainage and Channel System***

No additional work was recommended or has been performed on the drainage and channel system. Please see our July 8, 2015 memorandum for a discussion of the drainage and channel system status.

### ***Wave Attenuation Berms***

Wave attenuation berms were included in the design to reduce the potential for wave runup and erosion around the perimeter of the site, particularly where built assets exist. These berms are also intended to hasten vegetation establishment and encourage sediment deposition and faster aggradation of the overall subsided site. Vegetation establishment on the berms is important to limit wave erosion and help these features persist over time, as well as provide ecological and aesthetic benefits. Our design included two types of wave attenuation berms: (1) a wetland berm built to a top elevation around Mean Higher High Water (MHHW) at 9.2 ft NAVD 88 along channel edges, and (2) a riparian berm, built to around 11.2 feet NAVD 88 closer to the project perimeter and some channel edges, with the intent to plant them all with native shrubs.

Our July 8, 2015 memorandum recommended constructing four additional riparian berms and two additional wetland berms to attenuate wave action, as well as regrading the southern end of berm 20 to bring it to an elevation sufficient to sustain riparian plantings. These features were included in the original plan set and are intended to reduce the risk of wave runup and erosion where the fetch is the greatest across the site.

### **Summary and Conclusions**

We previously recommended that additional berms be added to the system that was built as of spring, 2015. The Tulalip Tribes followed these recommendations, installing four new riparian berms, two new wetland berms, and re-grading one existing berm.

As we noted in the July 8, 2015 memo, installation of all the designed berms was not possible due to budget constraints; therefore we recommend that the monitoring and adaptive management program be expanded to ascertain whether wave action induces erosion around the perimeter of the site and to assess if remedial actions along the site perimeter may be required.

Monitoring and adaptive management is a key element of the overall approach to identify and address potential erosion around the perimeter. Since the berm system built does not include all of the berms included in the original design, we recommend that additional focus be placed on monitoring and adaptive management of the perimeter side slopes. When high tides or river levels coincide with strong winds, observations should be made along the perimeter shoreline. Wave energy that reaches the perimeter will be mitigated via plantings, but some bio-engineering approaches or other spot fixes may be necessary if vegetation alone does not provide sufficient protection in combination with the berms that were constructed.

### **As-constructed Documents**

This description of as-constructed conditions, including drawings, has been prepared based on information provided by others and/or by limited field observation by ESA. ESA has not verified, and therefore does not warrant, the accuracy or completeness of all the information presented. Users of this as-constructed analysis update memo and these record drawings assume all risk of loss resulting from their use.